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E. H. REED

METHOD OF MAKING THREAD ROLLING DIES

Filed Aug. 22, 1923

Fig. 1.

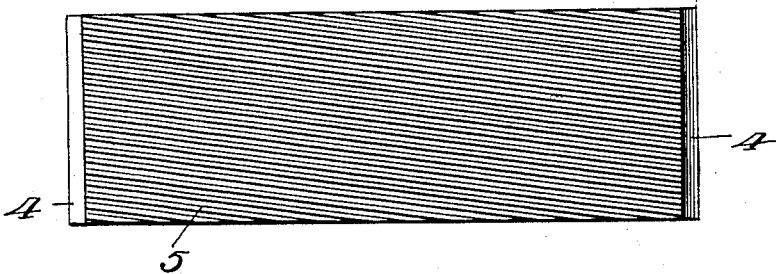


Fig. 2.

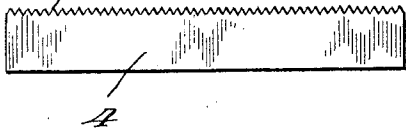


Fig. 3.

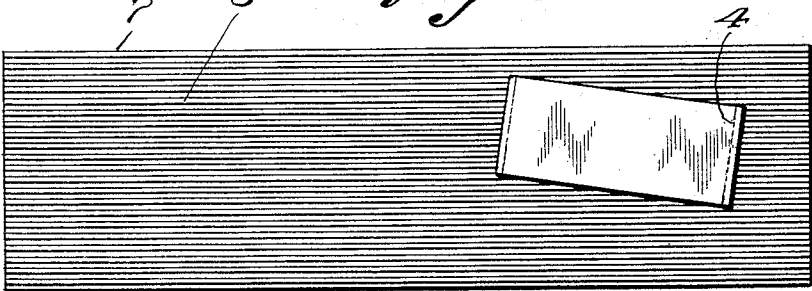
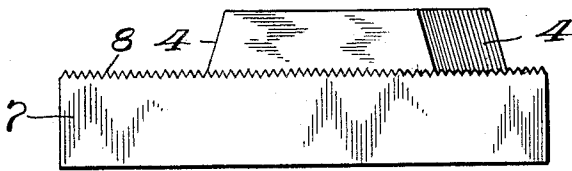


Fig. 4.



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METHOD OF MAKING THREAD-ROLLING DIES.

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To all whom it may concern:

Be it known that I, EDGAR HOWARD REED, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Methods of Making Thread-Rolling Dies, of which the following is a specification.

The present invention relates to the making of dies adapted for forming screw threads by the rolling method.

Up to the time of the present invention, it was generally considered by those skilled in this art, that the rolling method of forming screw threads is adapted only to the production of commercial threads where a wide tolerance of irregularities in their production is allowable, for example, such as the threads on wood screws, machine screws, bolts, and similar articles.

Several factors have been recognized as interfering with the production of fine and accurate screw threads by means of rolling dies. One factor is the impossibility of preventing the bulging and warping of thread rolling dies during the hardening operation to which they must be subjected after they have been cut to the desired form. This warping and bulging of the dies has resulted in the distortion of their working surfaces, and consequent irregularities in the threads which are cut by them. Up to the time of the present invention, no methods have been known for entirely preventing or correcting such distortion of the working surfaces of thread rolling dies.

Another factor which has interfered with the production of fine and accurate threads by the rolling method, has been the pitting and roughening of the working surfaces of the dies during the hardening operation, due principally to oxidation during the heating and cooling treatments. Attempts have been made to prevent or cure this roughening of the die surfaces, but without complete success, and the making of fine threads with thread rolling dies has been considered impractical largely for this reason.

Still another factor which has prevented the production of fine and accurate threads by the rolling method has been inaccuracies in the cutters by which the grooves in the dies have been cut. Even if such cutters are made with extreme care, the warping which takes place when they are hardened and tempered often introduces irregularities

in their cutting surfaces which are repeated in the dies cut by them. One of the most serious of such irregularities, when the aim is to produce fine and accurate threads, is the difference between the lead of adjacent grooves in the dies. Such irregularities, if left in the completed dies, of course are repeated in the screw threads produced by them.

The general object of the present invention is to provide a method of making thread rolling dies which are substantially free of the objectionable characteristics above mentioned. More specifically stated, the object of the invention is to provide a method for producing thread rolling dies in which the pitch plane of the thread cutting grooves is substantially a plane surface, and in which the working surfaces of the dies are smooth and free from pitting by oxidation, and in which the lead between adjacent threads of the dies is substantially uniform. The accomplishment of these objects, in the manner hereinafter described, has resulted in the production of thread rolling dies which are so nearly perfect that with them screw threads may be rolled commercially which are actually superior to similar threads produced commercially by cutting operations. For example, it is possible by means of dies made in accordance with the method hereinafter described, to form satisfactory threads upon the spindles of micrometers and similar measuring instruments in which threads of small pitch and close accuracy are required.

The method which forms the subject of the present invention is characterized by the fact that after the thread rolling dies have been cut to the desired shape and have been hardened and tempered, they are ground by reciprocating them with their grooved surfaces in engagement with a correspondingly grooved lap the surface of which is charged with abrasive material. This grinding treatment serves to eradicate inequalities in the die surfaces due to any bulging and warping which occurred during the hardening and tempering operation, and smooths the faces of the grooves in the die which may have become roughened or pitted. By reciprocating the dies in engagement with different portions of the grooved lap, the grinding operation also serves to equalize the lead between adjacent grooves in the dies.

The invention will be understood from the following description in connection with the accompanying drawing in which Figure 1 is a plan view of a thread rolling die of the kind which my method is adapted to make; Figure 2 is an end elevation, on a somewhat larger scale, of the die shown in Figure 1; Figure 3 is a plan of a flat lap showing a die thereon in position to be ground; and Figure 4 is an end elevation, on a somewhat larger scale, of the lap and die shown in Figure 3.

In carrying out my improved method, a piece of tool steel is formed to the desired shape, preferably by planing or milling, in the usual manner. Figures 1 and 2 show a die 4 having a grooved working surface of a form adapted for the rolling of V threads on a suitable spindle, it being understood that two dies of this kind are employed in the usual way. After the die has been cut to the desired shape, it is hardened and tempered in any preferred manner, with the usual precautions to reduce to a minimum the bulging, warping and roughening of the working surface which usually occurs. All portions of the working surface of the die are then ground by reciprocating the die in engagement with a correspondingly grooved lap the surface of which is charged with abrasive material such as oil and fine emery. In Figures 3 and 4, there is shown a lap 7, of cast iron or other suitable material, which, after being planed or otherwise formed with as nearly a true plane surface as possible, is grooved by milling or planing in the same manner and with grooves of the same form as in the case of the dies. As shown, the grooves 8 in the lap extend longitudinally thereof, and the length of the lap is considerably longer than the length of the dies to be ground upon it. The dimensions of the lap with reference to the die to be ground upon it may, however, be widely varied.

As shown in the drawing, a die 4 is laid with its working face downward in engagement with the correspondingly grooved top of the lap, after the lap has been charged with the abrasive material. The die is then reciprocated longitudinally of the lap, either by hand or by some suitable mechanism, and the grinding of all portions of the working surface of the die begins. Cast iron, by reason of its nature, tends to hold the particles of abrasive material, and such particles present their angles and edges to the die as it is reciprocated over the lap. As the grinding proceeds, the high spots or areas in the working surface of the die produced by the hardening operation are ground down, thereby making the pitch plane of the grooves or threads of the die more nearly a true plane surface. This operation does not materially change the

form of the die threads, as the cutting off of the peaks of portions of the die threads and the deepening of portions of the grooves between the die threads is accompanied by corresponding cutting of the side slopes of the threads. From time to time, as the grinding operation proceeds, the die is lifted and moved transversely of the lap so that the die will cooperate with different portions of the lap. By so changing the co-operative relation of the die and lap, slight differences in the lead between adjacent threads of the die are substantially equalized by grinding action, thereby producing a die having a substantially constant lead between threads. The grinding operation also smooths the working surfaces of the die which may have become pitted during the hardening and tempering operation.

Although Figures 3 and 4 show the die resting with its working surface downward in engagement with the upturned face of the lap during the grinding operation, it is to be understood that this relative arrangement of the lap and die is neither necessary nor desirable under all conditions. The drift of the abrasive loosened during the lapping or grinding operation being downward, there is a tendency for the grinding operation to take a little more off the tops or peaks of the threads of the die than off the bottoms of the grooves between the die threads, when the die is ground with its working surface downward. Under some circumstances, it may be desirable to counteract this tendency or produce the opposite effect by reciprocating the lap and die with reference to one another, with the working surface of the die facing upwardly and the working surface of the lap facing downwardly. It may even be that other relative positions of the lap and die may be found desirable under some conditions, bearing in mind the objects of the grinding operation, as herein described.

The grinding operation above described is continued until the working surfaces of the die have been given the advantageous characteristics hereinbefore mentioned, whereupon the die is ready to be used in co-operation with a similarly made die for the production of screw threads which will accurately conform to the desired shape.

While the method of making thread-rolling dies which forms the subject of the present invention, has been described in connection with the making of the flat type of thread-rolling dies, it will be understood that it is equally applicable to the making of the cylindrical or rotary type of thread-rolling dies. After the working surfaces of such rotary thread-rolling dies have been formed to the desired shape and hardened in the usual manner, they can be finished in the manner herein described and claimed, it

being of course understood that the laps used for finishing them have grooved cylindrical surfaces, the pitch radii of which correspond to the pitch radii of the cylindrical surfaces of the respective dies, such laps being flat in this sense.

What I claim is:

1. The method of making rolling dies which consists in forming the working surface of the die to the desired shape, hardening and tempering it, and then reciprocating it with its working surface in engagement with a correspondingly formed flat lap the surface of which is charged with abrasive material.

2. The method of making thread rolling dies which consists in forming the working surface of the die to the desired grooved shape, hardening and tempering it, and then reciprocating it with its grooved working surface in engagement with a correspondingly grooved flat lap the surface of which is charged with abrasive material.

3. The method of making thread rolling dies which consists in forming the working surface of the die to the desired grooved shape, hardening and tempering it, and then reciprocating it with its grooved surface in engagement with different portions of a correspondingly grooved lap the surface of which is charged with abrasive material.

4. The method of making thread rolling dies which consists in cutting the working surface of the die to the desired grooved shape, hardening and tempering it, and then reciprocating it with its grooved surface in engagement with a correspondingly grooved flat lap the surface of which is charged with abrasive material.

5. The method of making thread rolling dies which consists in cutting the working surface of the die to the desired grooved shape, hardening and tempering it, and then reciprocating it with its grooved sur-

face in engagement with different portions of a correspondingly grooved lap the surface of which is charged with abrasive material.

6. The method of finishing the grooved working surface of a thread rolling die which consists in reciprocating the die with its working surface in engagement with the surface of a correspondingly grooved flat lap which is charged with abrasive material.

7. The method of finishing the grooved working surface of a thread rolling die which consists in reciprocating the die with its working surface in engagement with different portions of a correspondingly grooved lap which is charged with abrasive material.

8. The method of finishing the grooved working surface of a thread rolling die which consists in placing the die with its working surface in engagement with the surface of a correspondingly grooved lap which is charged with abrasive material, and then reciprocating the die and lap with reference to one another, part of the time with the working surface of the lap downward and the remainder of the time with its working surface upward.

9. The method of finishing the grooved working surface of a thread rolling die which consists in placing the die with its working surface in engagement with different portions of the surface of a correspondingly grooved lap which is charged with abrasive material, and then reciprocating the die and lap with reference to one another, part of the time with the working surface of the lap downward and the remainder of the time with its working surface upward.

Signed at Worcester, Mass., this 20th day of August, 1923.

EDGAR HOWARD REED.